Engineering Systems & Health Care:
A LUMS Possibility?

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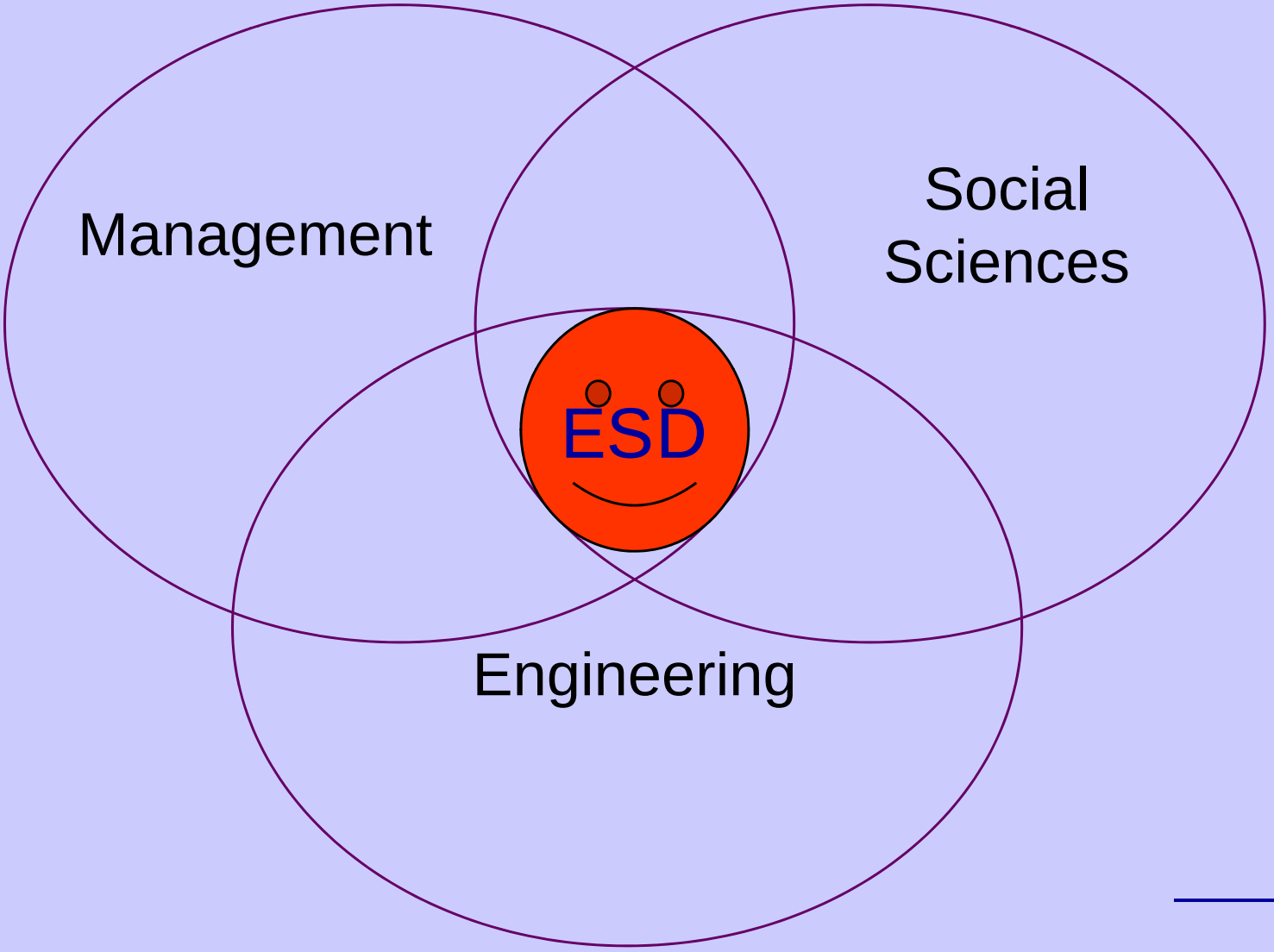
Definition of Engineering Systems

- Engineering Systems are
  - Technologically enabled Networks & Meta-systems which transform, transport, exchange and regulate Mass, Energy and Information
  - Large-scale
  - Socio-technical aspects
  - Nested complexity
  - Dynamic
    - involving multiple time scales,uncertainty & lifecycle issues
  - Likely to have emergent properties

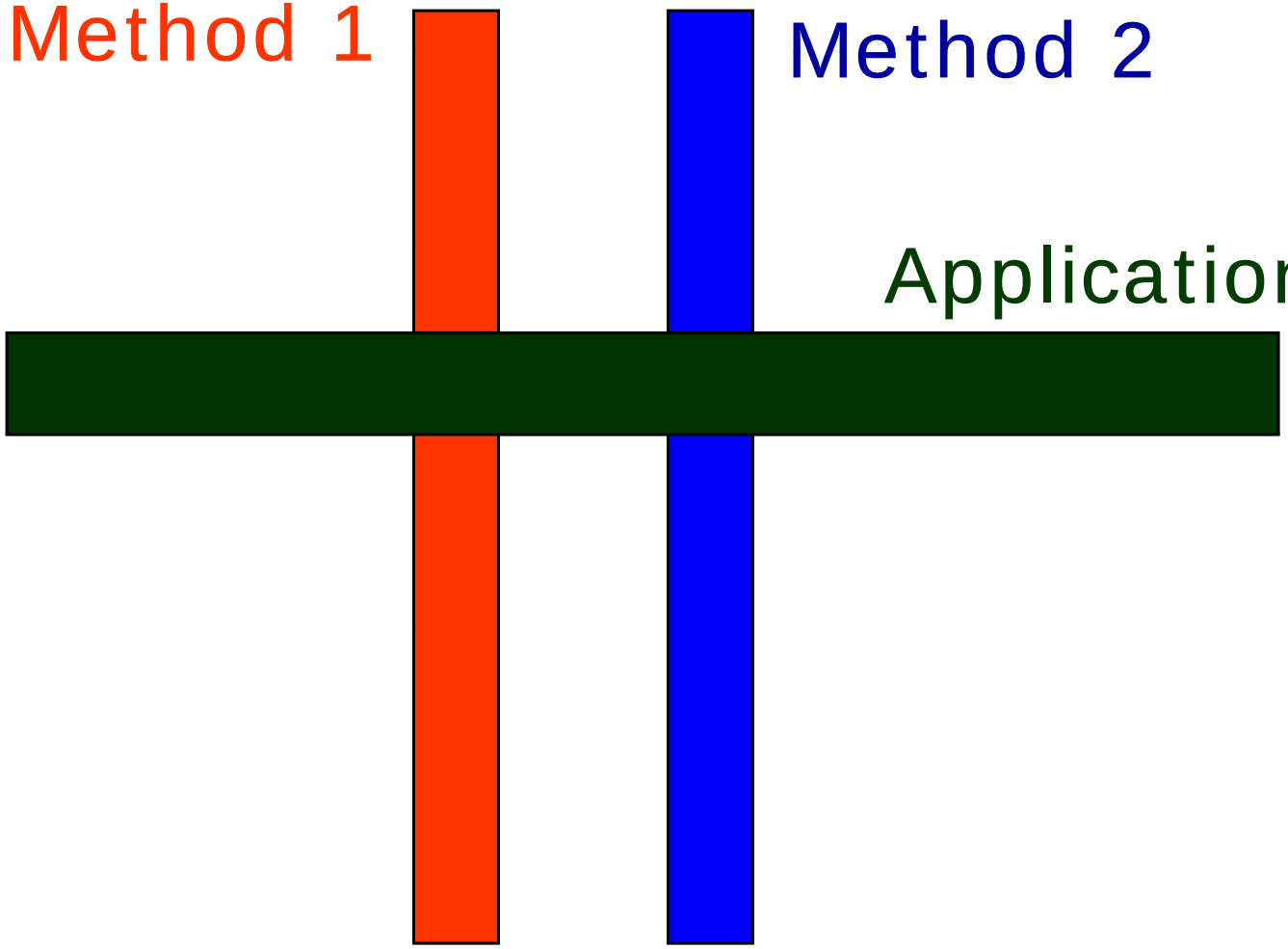
- Examples are
  - Air and Ground Transportation Systems, an e-Learning system, any major part of a health care system, the National electric power grid.

These systems exist & have "messy complexity"

Engineering Systems: At the intersection of Engineering, Management & Social Sciences



Typical Engineering Systems Research: Cross-cutting Application & Methodology



Professional Recognition

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

If we are successful, the professional communities of ***both*** context and method should value our work.

https://secure.friendshiphouse.com/E90167t.gif

Example: Pandemic Influenza

- Social Distancing and Hygienic Steps Analysis via Mathematical Modeling, difference equations and social networks
- Add historical research on 1918-1919 *Spanish Flu*
- By social distancing measures, see how low we collectively can make the 'flu multiplier' R_0

Nation ill-prepared for flu

By Richard C. Larson/ As You Were Saying . . .
Saturday, October 22, 2005

Avian flu. It's all over the news. The governor is telling us to stockpile supplies ``just in case.'' But if this year has taught us anything, it's that we need carefully planned and rehearsed disaster plans - whether we speak of tsunamis, hurricanes, earthquakes or flu pandemics.

Experts tell us that a flu pandemic will arrive here, we just do not know when. Let us hope that it is not this year, as we are woefully unprepared.

We simply do not know enough to design a comprehensive system for the nation. A system must represent our collective best thinking and research in social sciences, medical sciences, systems sciences and management sciences. The ``engineering'' of such a system is what some at MIT have called ``Big E Engineering,'' moving from the traditional engineering design of components to the design of much larger, more complex social-technical systems.

Let's frame the problem in a bit of history. The year 1918 is etched in the minds of Bostonians. It was the last time, before 2004, that the Red Sox won the World Series. It was also the last time, before 2004-2005, that the National Hockey League's Stanley Cup was not awarded.

Why? That season was terminated early due to the 1918-1919 flu pandemic. On Oct. 2, 1918, 202 Bostonians died of the flu. The World Series was played earlier that year - just after Labor Day - because of World War I.

But the war and the Red Sox victory were two of several distractions that caused Bostonians to delay effective response to the lethal flu. Boston was the first urban epicenter of the last great flu pandemic in the United States. This selective amnesia must be cured in order to address future catastrophes.

We need a comprehensive analysis of the entire U.S. response to a flu pandemic, with eyes wide open to all sorts of new behaviors brought about by a pandemic - the first in the lifetimes of 99 percent of Americans.

While government bureaucrats have spoken of quarantining Manhattan should a flu outbreak occur there, a plausible (but untested) alternative is that the nation will be gripped by self-isolation. People may self-quarantine even when healthy. Close the schools? No need to mandate it, because parents and students will voluntarily stay away. Maybe we'll do home schooling or e-learning over the

In the *Boston Globe*:

Bay State not ready for a flu epidemic

$36.5m Romney plan shelved by Legislature

By Stephen Smith, Globe Staff | October 3, 2006

Eight months after Governor Mitt Romney asked legislators to spend $36.5 million to rapidly prepare the state for an influenza epidemic, not a single additional hospital bed, breathing machine, or bottle of medicine has been purchased.

Recent news has suggested that in a pandemic flu situation, developing countries will be the hardest hit, just as they were in 1918-1919, when up to 50,000,000 died within months.

LUMS Engineering Systems faculty could do applied research leading to recommendations on a national strategy, subject to constraints of budget and social/cultural acceptability.

LUMS, Health Care and Engineering Systems

- To be successful, would need ties to a medical school.
- Would need 'critical mass,' leveraging also the other schools of LUMS.
- Would need access to research grants, awarded by merit.
- Would need students who wanted to become "T persons," specialized both in Engineering Systems and -- for now, at least -- Health Care Systems.

Other Possible Health Care Problem Areas

- Health Care systems in rural areas.
- Health surveillance systems.
- Hospital management systems.
- Undertaking basic research to understand relationships between and among health status of a population and and other issues such as
  - Educational attainment, males and females.
  - Economic well-being, including jobs availability.
  - Access to up-to-date medical information.